

Reg. No. :

Name :

Third Semester B.Sc. Degree Examination, February 2024

First Degree Programme under CBCSS

Physics

Complementary Course for Mathematics

PY 1331.1 : OPTICS, MAGNETISM AND ELECTRICITY

(2018 Admission Onwards)

Time : 3 Hours

Max. Marks : 80

SECTION – A

Answer **all** questions in **one** or **two** sentences. Each question carries **1** mark.

1. Why the center of Newton's rings is dark for reflected light?
2. How is air wedge formed?
3. Why diffraction is common in sound but not common in light?
4. What is a grating?
5. What would happen when the circular aperture in Fresnel's diffraction is replaced by a circular disc of the same radius?
6. What is an optical fibre? What is its principle?
7. Explain population inversion.
8. Define the term magnetic susceptibility.
9. Explain the term relative permeability.
10. Why the core of a transformer made of laminated sheets?

(10 × 1 = 10 Marks)

P.T.O.

SECTION – B

Answer any **eight** questions, not exceeding a paragraph. Each question carries **2** marks.

11. State and explain superposition principle.
12. What are coherent sources? What are the two methods to obtain coherent sources?
13. Why a soap bubble in bright sunlight is beautifully colored?
14. What is band width? Obtain an expression for band width of interference fringes?
15. What is the difference between Fresnel's and Fraunhofer diffraction?
16. What are the assumptions made Fresnel to explain the diffraction pattern?
17. How will you determine the wavelength of light by the diffraction fringes of straight edge?
18. What is a graded index fiber? What is its advantage over step index fiber?
19. Draw the energy level diagram of ruby laser.
20. Explain the difference between ferromagnetism and antiferromagnetism?
21. What is meant by hysteresis in magnetic materials?
22. Explain the term sharpness of resonance?

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six**, each question carries **4** marks.

23. Two sources of intensities I and $4I$ are superimposed. Obtain the intensities where the phase difference is $\pi/2$.
24. Light of wavelength $5880 \text{ \AA}$ is incident on a thin film of glass of $\mu = 1.5$ such that the angle of refraction in the plate is 60° . Calculate the smallest thickness of the plate which will make it dark by reflection.
25. In Young's double slit experiment the separation of the slit is 1.9 mm and the fringe spacing is 0.31 mm at a distance of 1 m from the slits. Calculate the wavelength of the light?
26. Find the half angular width of the central bright maximum in the Fraunhofer diffraction pattern of a slit of width $12 \times 10^{-5} \text{ cm}$ when the slit is illuminated by monochromatic wavelength $6000 \text{ \AA}$.

27. A monochromatic light of wavelength $5000 \text{ \AA}$ from a distant source falls on a slit 0.5 mm wide. What is the distance between the two dark bands on each side of the central band of the diffraction pattern observed on a screen placed 2 m from the slit.
28. A plane wave of wavelength $6 \times 10^{-7} \text{ cm}$ incident normally on a circular aperture of radius 0.01 cm . Calculate the positions of the brightest and the darkest points on the axis.
29. A bar magnet place with its axis at 30° with a uniform magnetic field of 0.25 T experiences a torque of magnitude equal to $4.5 \times 10^{-2} \text{ J}$. What is the magnitude of magnetic moment of the magnet?
30. A solenoid of 2000 turns and area of cross section $1.6 \times 10^{-4} \text{ m}^2$ carrying a current of 4 A is suspended through its centre allowing it to turn in a horizontal plane. What is the magnetic moment associated with the solenoid?
31. An a.c voltage of peak value 283 V and frequency 50 Hz is applied to a series LCR circuit in which $L = 25.48 \text{ mH}$, $C = 796 \mu\text{F}$, and $R = 3 \Omega$. Find the impedance of the circuit?

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions. **Each** question carries **15** marks.

32. Explain the formation of the Newton's rings. How can these be used to determine the wavelength of monochromatic light.
33. Discuss the Fraunhofer diffraction due to a double slit in detail.
34. On the basis of modern electron theory, briefly explain diamagnetism and paramagnetism?
35. Obtain an expression for a current in a series LCR circuit? Also deduce an expression for impedance and resonance in the circuit.

(2 × 15 = 30 Marks)